Claims:

1. A reactor comprising a reaction zone and heat exchange means of the plate type in operative contact with the reaction zone so as to receive reactants for heat exchange purposes, wherein the heat exchange means is formed from a plurality of superposed metal plates wherein fluid flow channels have been formed, according to a pre-determined pattern, said channel-bearing plates being aligned during superposition to define discrete heat exchange pathways for fluids and diffusion bonded together.

2. A reactor according to claim 1 wherein the reaction zone comprises of at least one catalyst bed.

3. A reactor according to claim 1 wherein the fluid flow channels have been formed by chemically etching said channel-bearing plates.

4. A reactor according to any claim 1 wherein the fluid flow channels have been formed by hydraulically etching said channel-bearing plates.

5. A reactor according to claim 1 wherein multiple heat exchange panels are embedded within the reaction zone, the design being such that the contact face area of the panels is similar to the contact face area of the reaction zone.

6. A reactor according to claim 1, wherein a plurality of reaction zones are arranged in succession having a heat exchange panel arranged between each zone.

7. A reactor according to claim 6, wherein at least 3 reaction zones are arranged in series.

8. A reactor according to claim 1, wherein each of the heat exchangers used in the reactor comprise panels that are of the printed circuit heat exchanger type (PCHE).

9. A reactor according to claim 1, wherein the catalyst is selected from spherical, cylindrical, and hollow bodies, solid particles, expanded or porous solids, wire or woven gauze coated matrix catalyst and the like supported catalysts.

10. A reactor according to claim 1, wherein a screen is provided to restrain catalyst particles from entering the passages of the PCHE.

11. A reactor according to claim 1, wherein the panel has a thickness of up to about 100 mm.

12. A reactor according to claim 1, wherein the panel design provides passages comprising tortuous pathways with convolutions and or zigzags to enhance heat transfer.

13. A process for conversion of a fluid reactant in a reactor comprising reaction zone and heat exchange means of the plate type in operative contact with said bed and having discrete fluid pathways for heat exchange between fluids at differing temperatures whilst avoiding mixing of the fluids, the said process comprising, providing the appropriate fluid reactant species to be converted in the reaction zone within the reactor and at a predetermined stage of reaction introducing at least a portion of the fluid reactant species into a reactant fluid pathway within said heat exchange means, and also introducing an auxiliary fluid at a temperature differing from that of the fluid reactant species into another fluid pathway within said heat exchange means and juxtaposed to the first whereby the discrete nature of the respective pathways permits indirect heat exchange between the fluid reactant species, said process being optionally repeated in successive stages.

14. An apparatus for controlling the temperature profile of a reactant fluid in the presence of a catalyst during an endothermic or exothermic chemical reaction, comprising a reactor having reactant fluid inlet means and reactant fluid outlet means; catalytic beds being provided therebetween, spaced apart by a printed circuit heat exchanger (PCHE); said heat exchanger comprising heat exchanging fluid inlet means, heat exchanging fluid outlet means, a first channel or set of channels for passage of the heat exchanging fluid, and a second channel or set of channels in communication with the adjacent catalytic beds to allow passage of the reactant fluid from one catalytic bed to the next, said second channel or set of channels not being in communication with the reactant fluid.

15. An apparatus according to claim 11, wherein different catalysts are provided in separate catalytic beds.

16. An apparatus according to claim 11, wherein heat exchange fluid is selected from molten salts, molten metals or hot water or other hot liquids, hot gases, steam, superheated steam, chilled liquids and chilled gases, vaporising or condensing fluids.

17. Apparatus according to claim 11, wherein there is provided additional means enabling provision of a moving bed reactor, namely catalyst inlet means, catalyst outlet means and means for feeding new or regenerated catalyst into the catalyst inlet means, and further means to remove catalyst from the catalyst outlet means.

18. A process for indirectly controlling the temperature profile of a reaction fluid in the presence of a catalyst during an endothermic or exothermic chemical reaction, comprising passing a reactant fluid from a reactant fluid inlet means in a reactor to a first catalytic bed before passing through a first channel or set of channels in a printed circuit heat exchanger (PCHE) and subsequently passing said fluid to a second catalytic bed; passing a heat exchanging fluid from a heat exchanging inlet means to a heat exchanging outlet means through a second channel or set of channels in the said printed circuit heat exchanger (PCHE); and exchanging heat between the heat exchanging fluid and the reactant fluid whilst passing through the said printed circuit heat exchanger (PCHE) the products of the reaction leaving the last catalytic bed being passed to a reaction fluid outlet means.